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Pasqua

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(54) **BICYCLE ELECTRIC FRONT DERAILLEUR**

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F16H 63/00	(2006.01)
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USPC 474/80, 82
See application file for complete search history.

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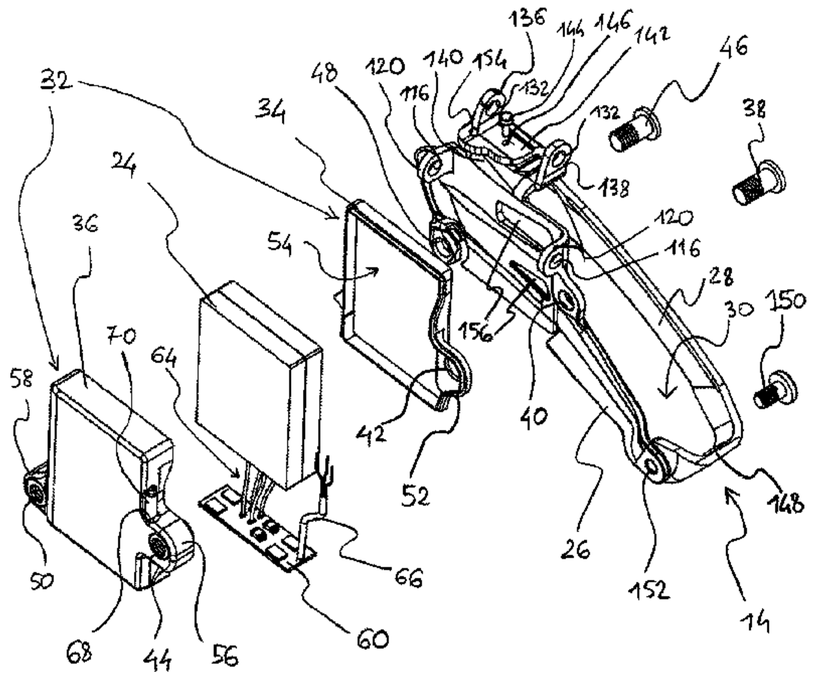
(57) **ABSTRACT**

A bicycle electric front derailleur is disclosed that includes a support body that is configured to be attached to a frame of the bicycle, a chain guide connected to the support body through a linkage, an electric motor that drives the linkage to displace the chain guide among toothed wheels of a motion transmission system, and a battery power supply unit. The battery power supply unit is supported by the chain guide.

19 Claims, 9 Drawing Sheets



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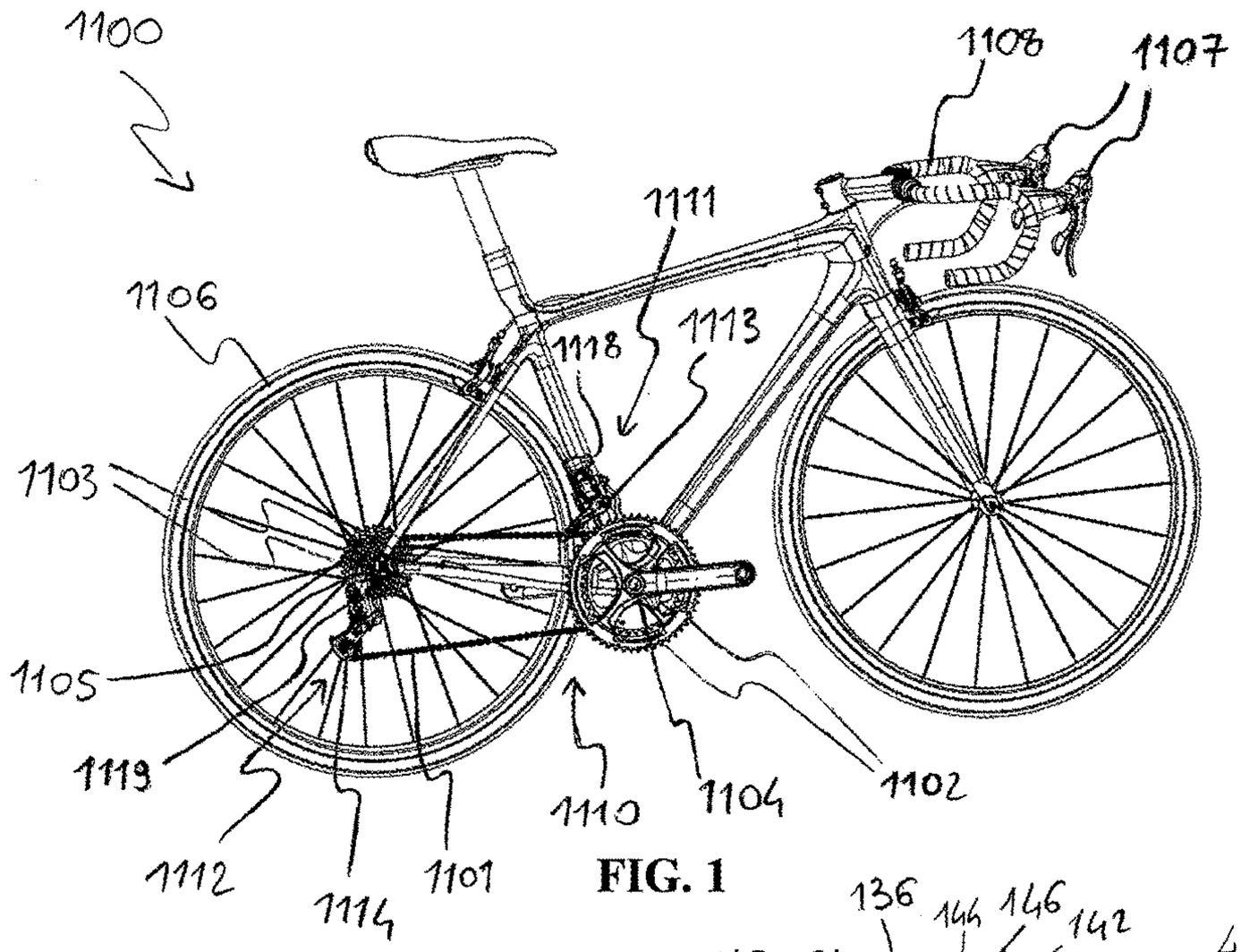
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FIG. 1

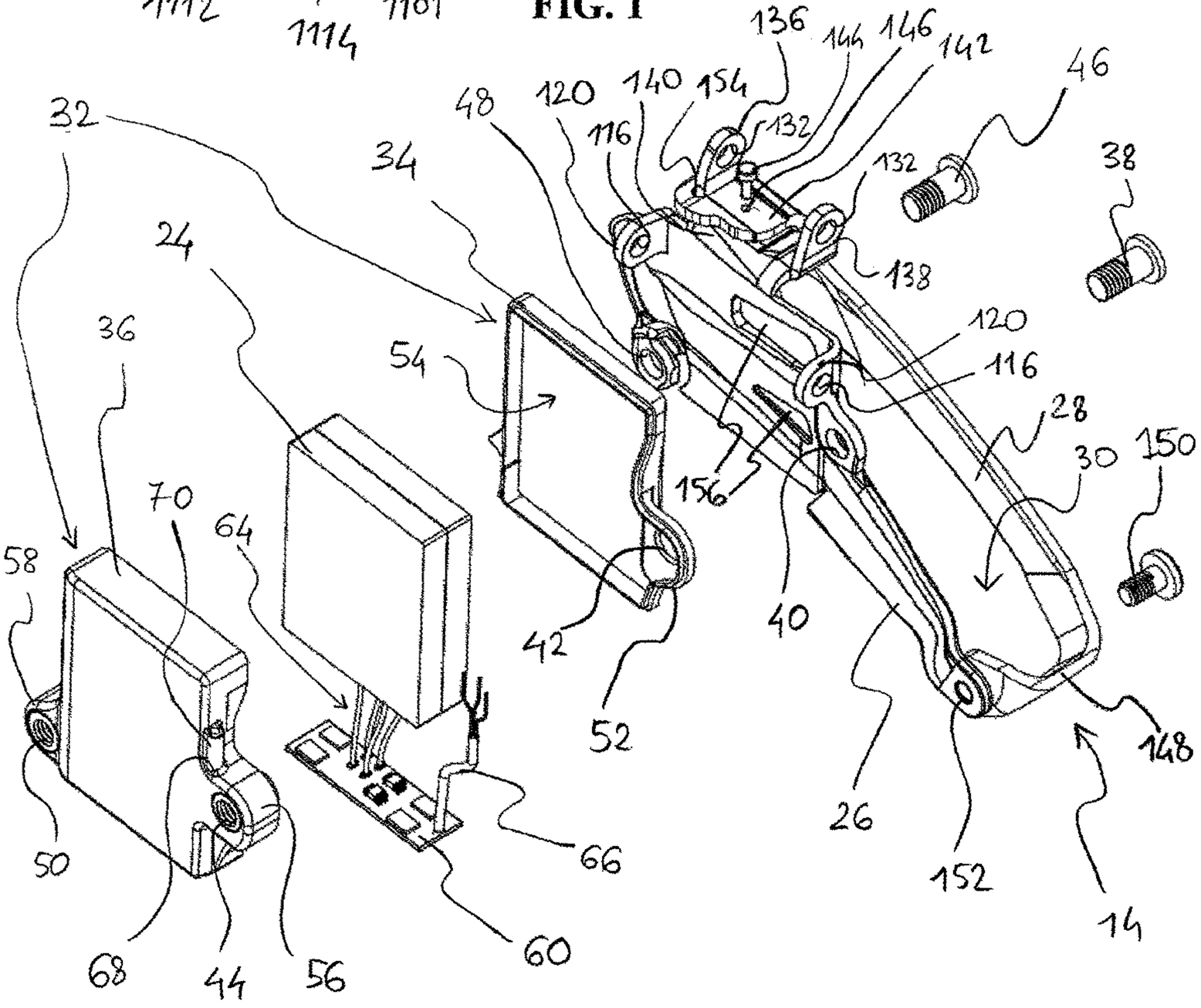
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FIG. 4

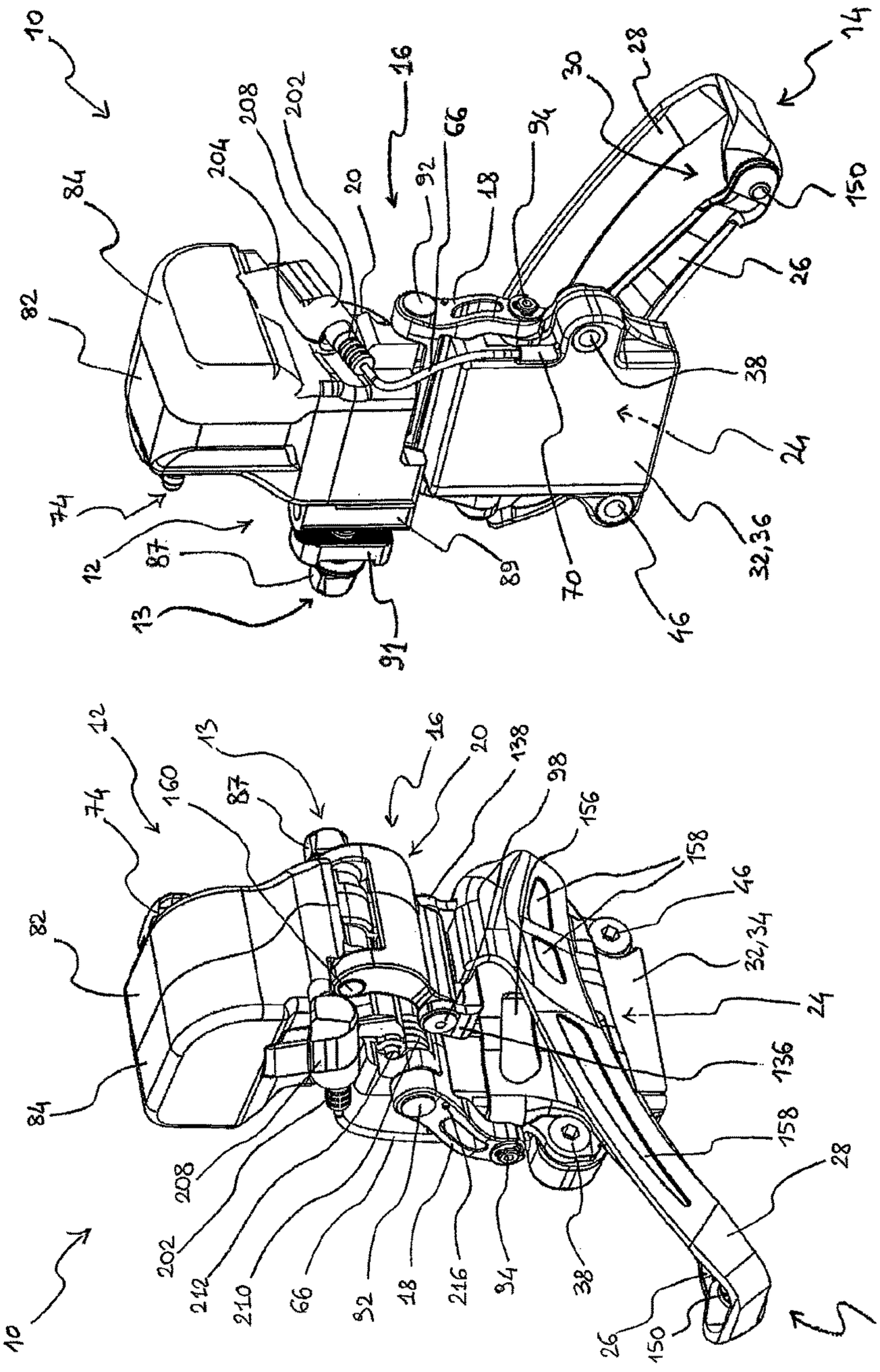
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FIG. 3

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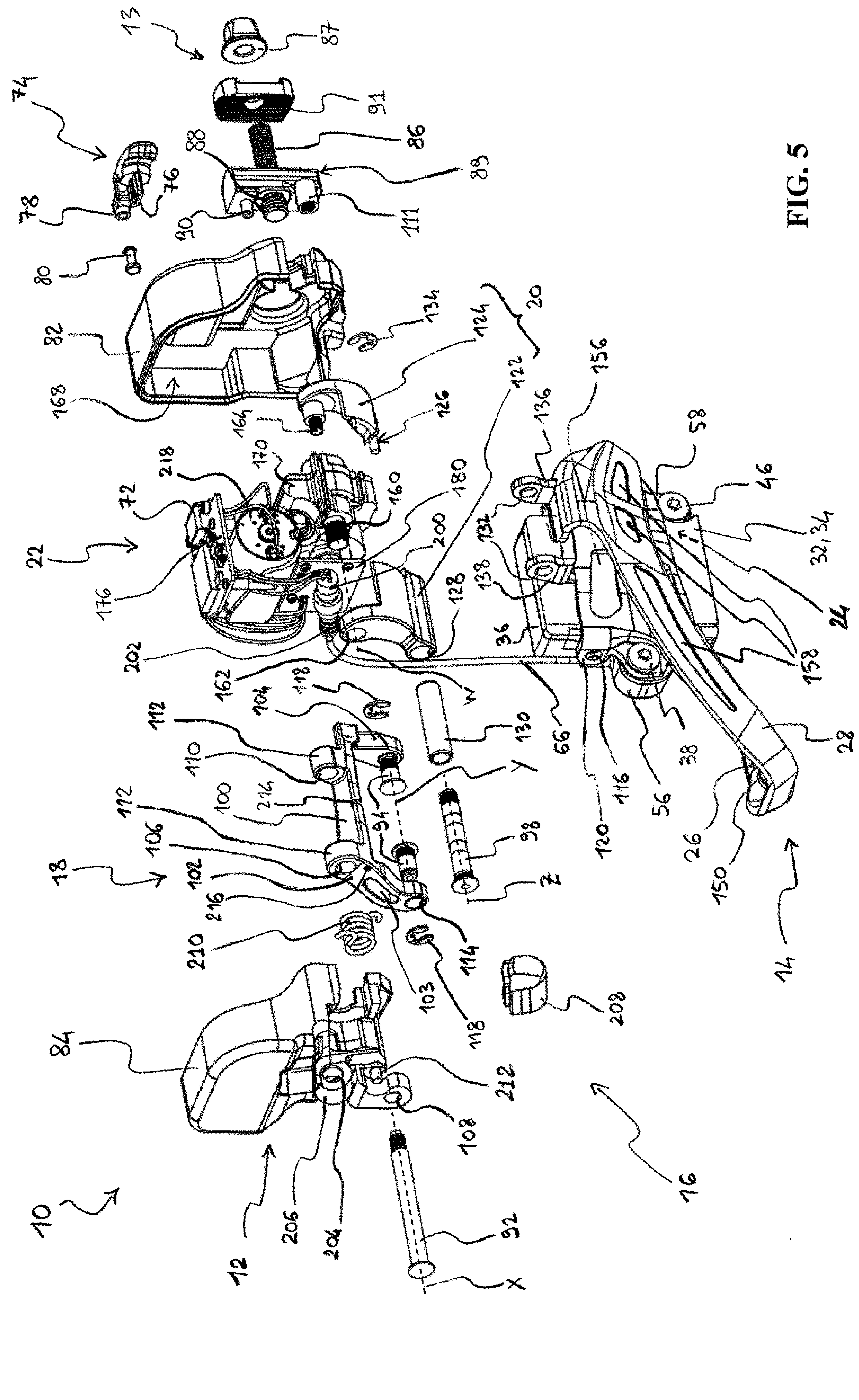
FIG. 2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Y
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102
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FIG. 5

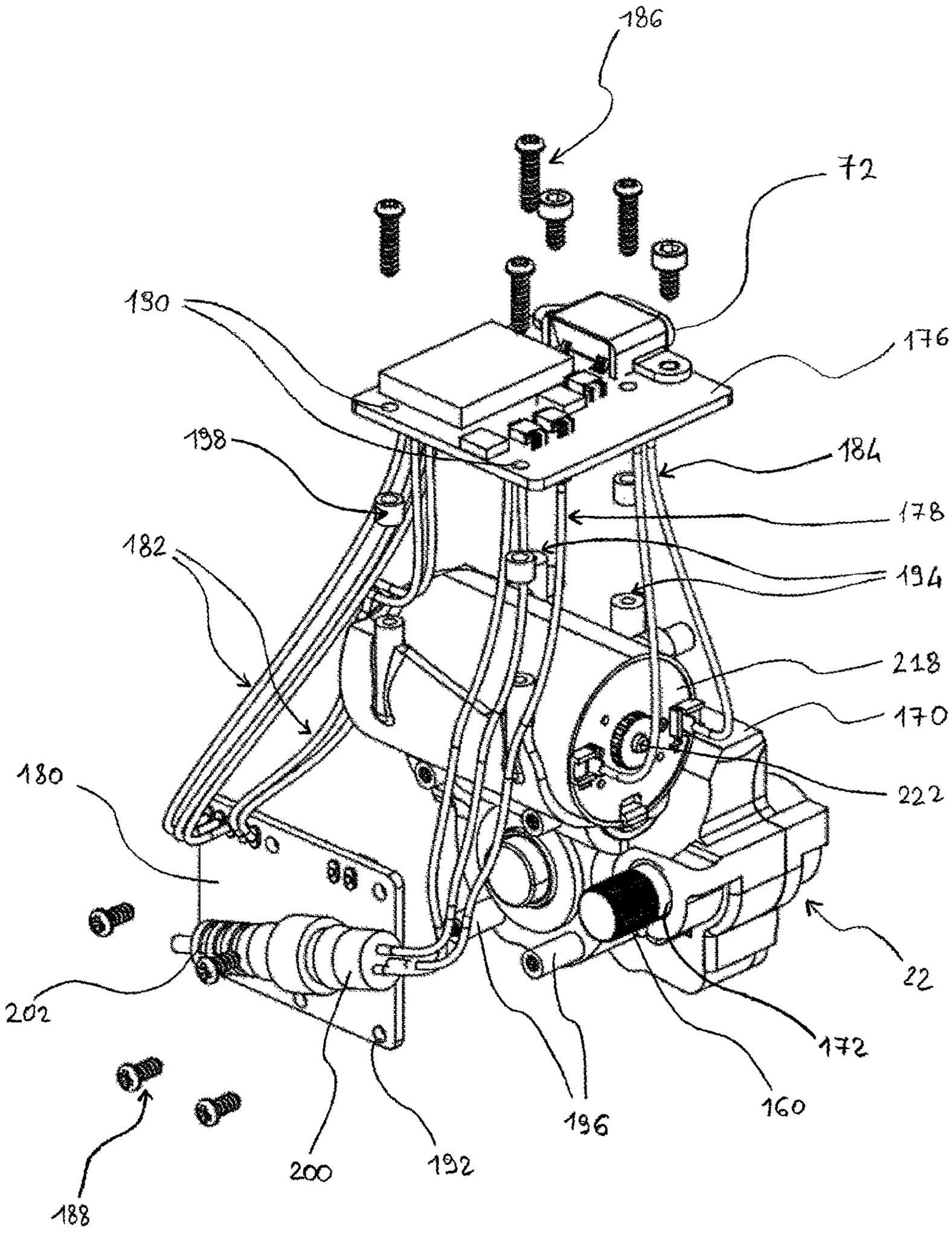
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FIG. 6

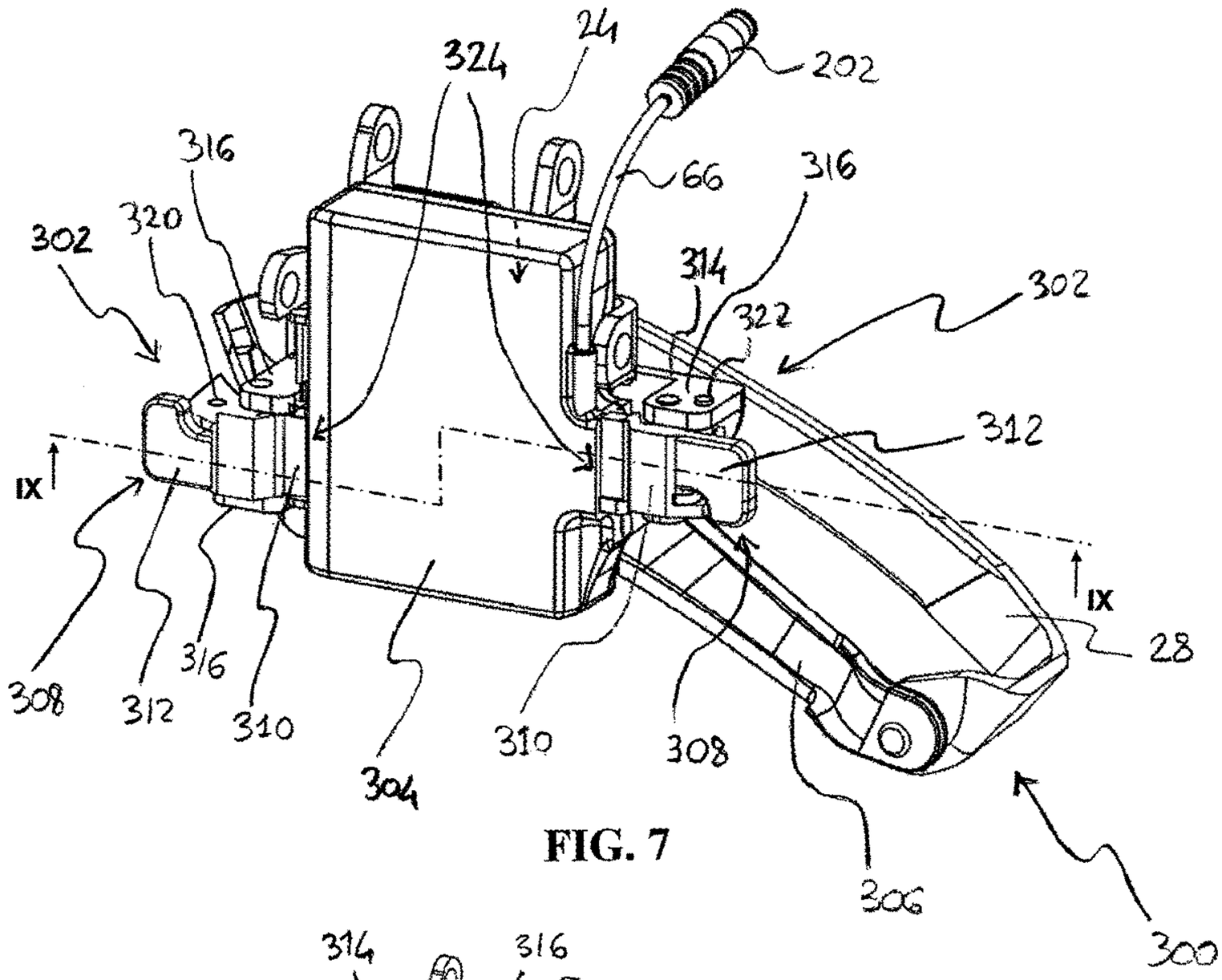
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FIG. 7

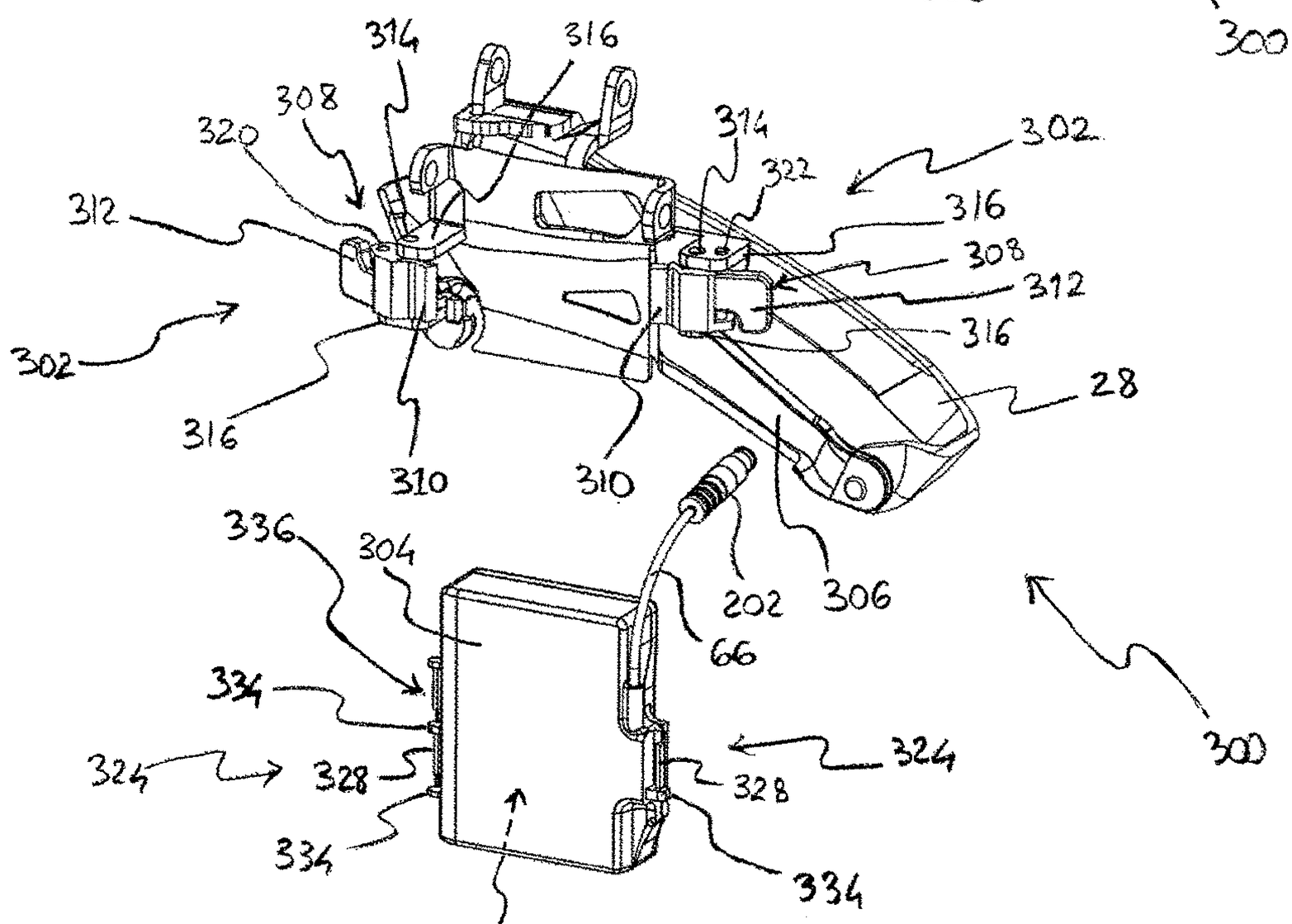
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FIG. 8

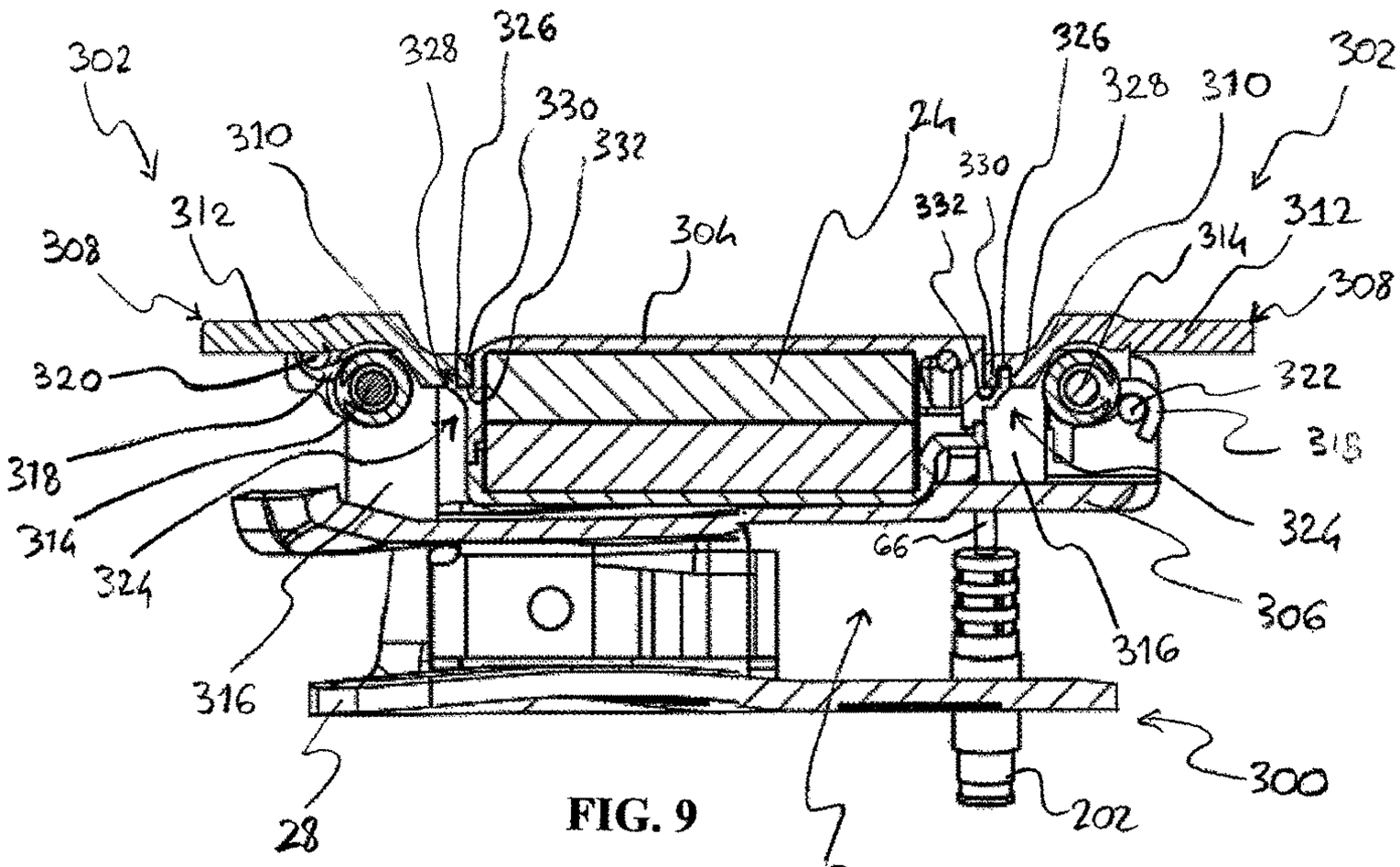
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FIG. 9

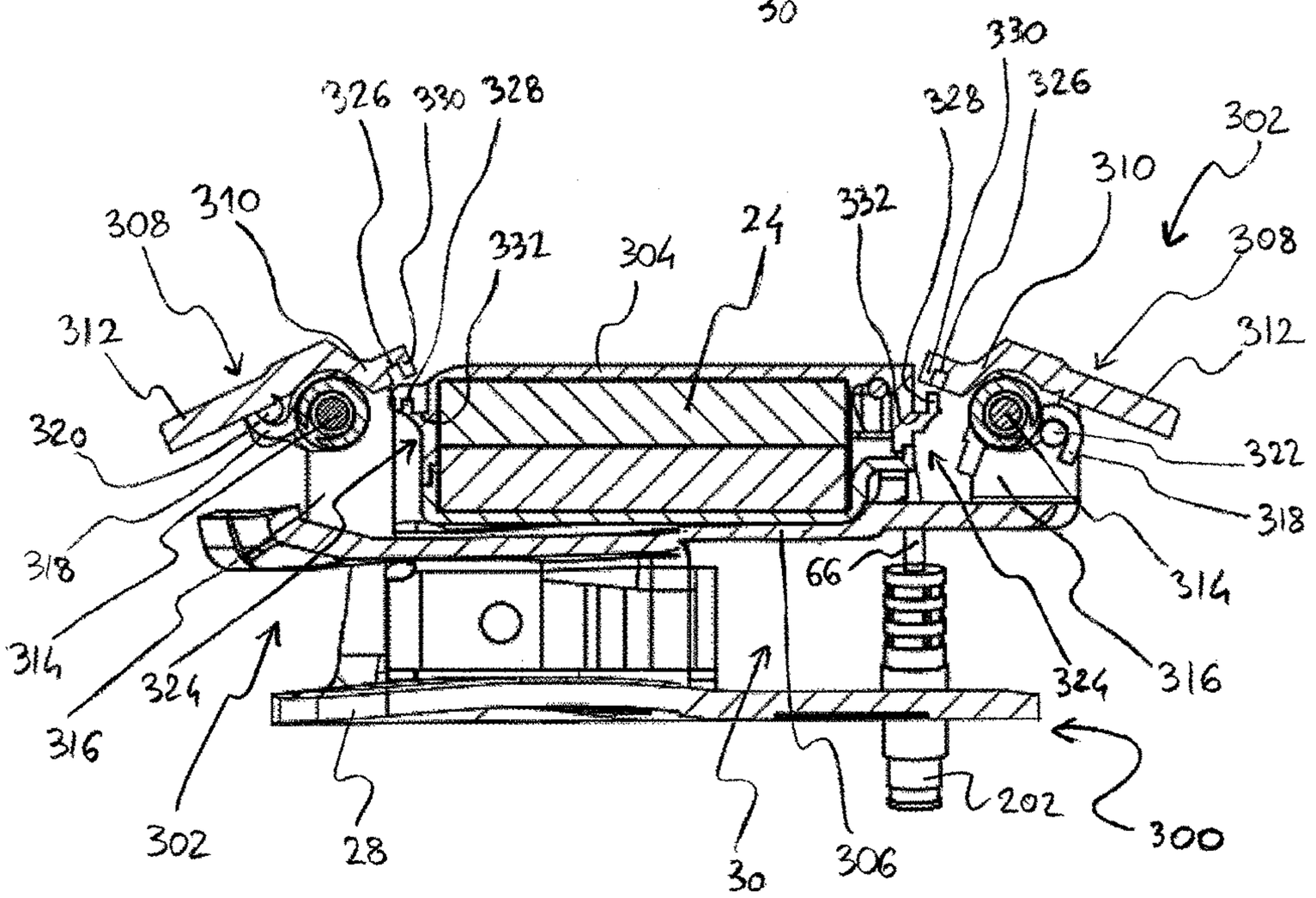
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FIG. 10

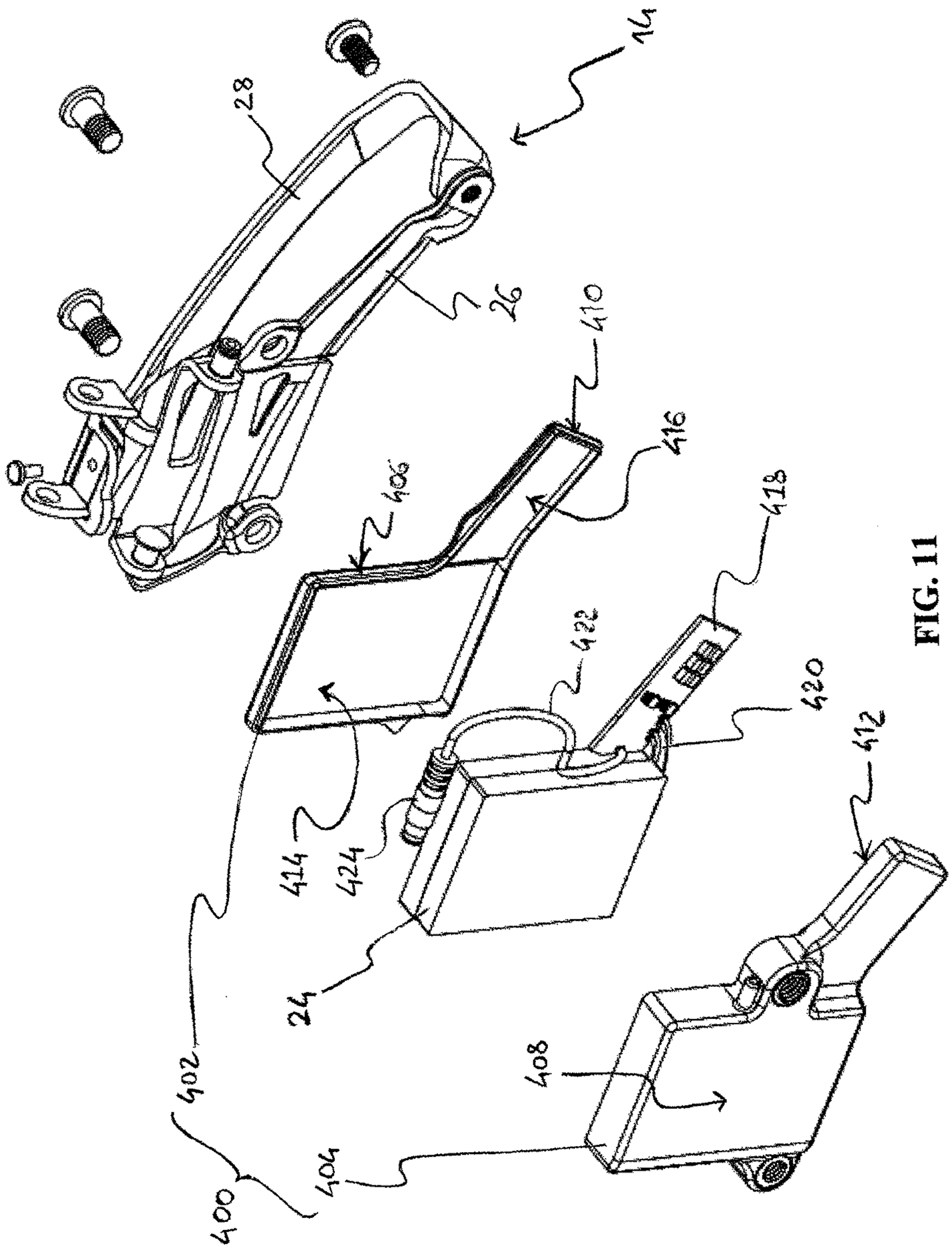

FIG. 11

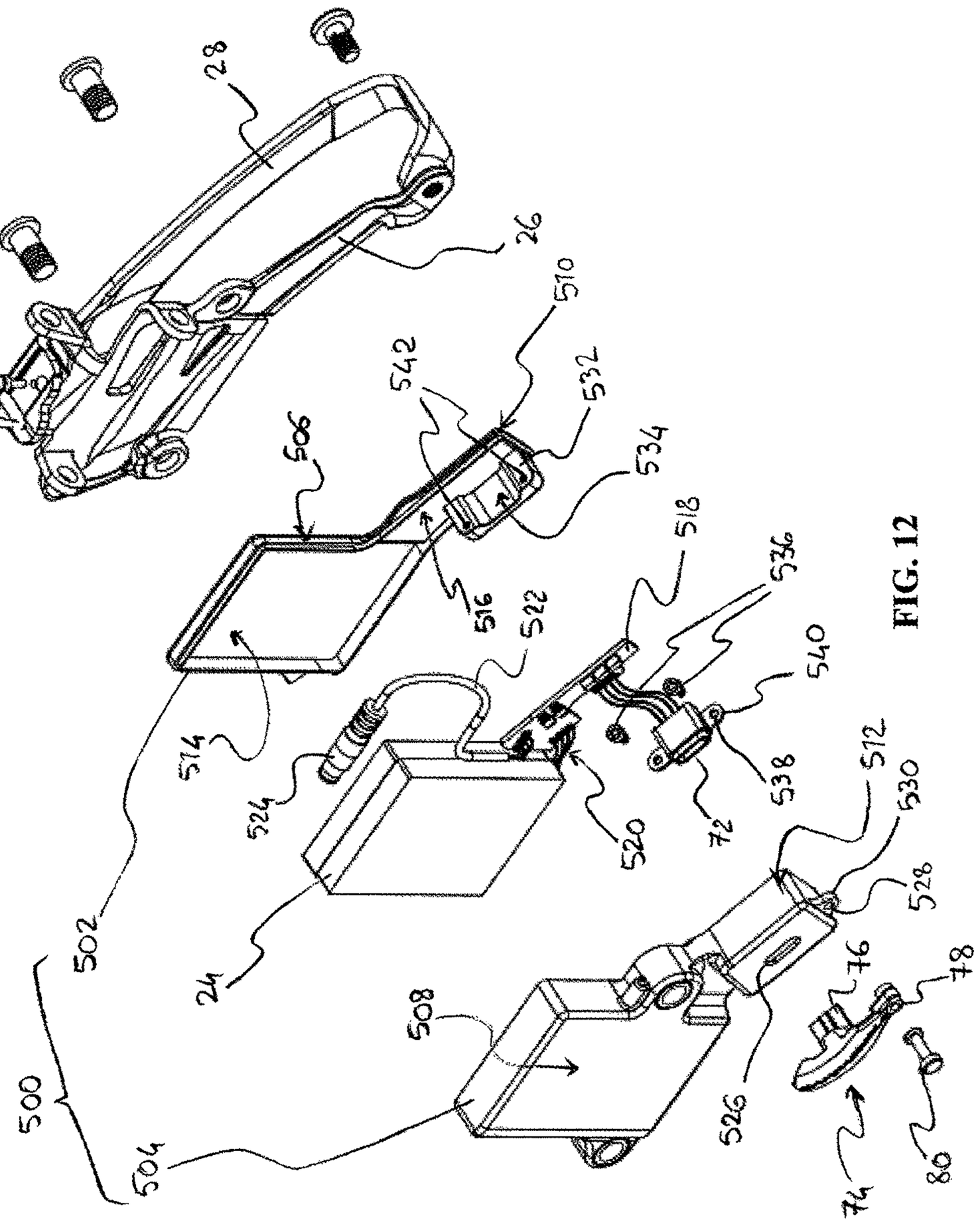
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FIG. 12

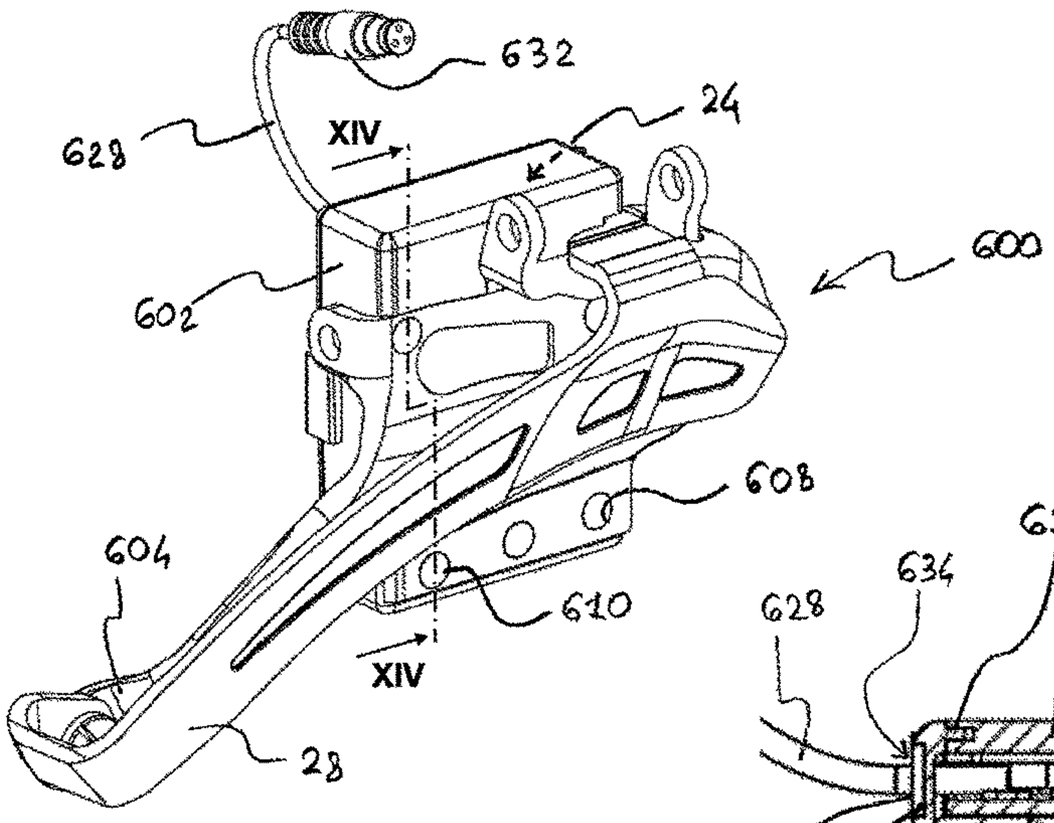

FIG. 13

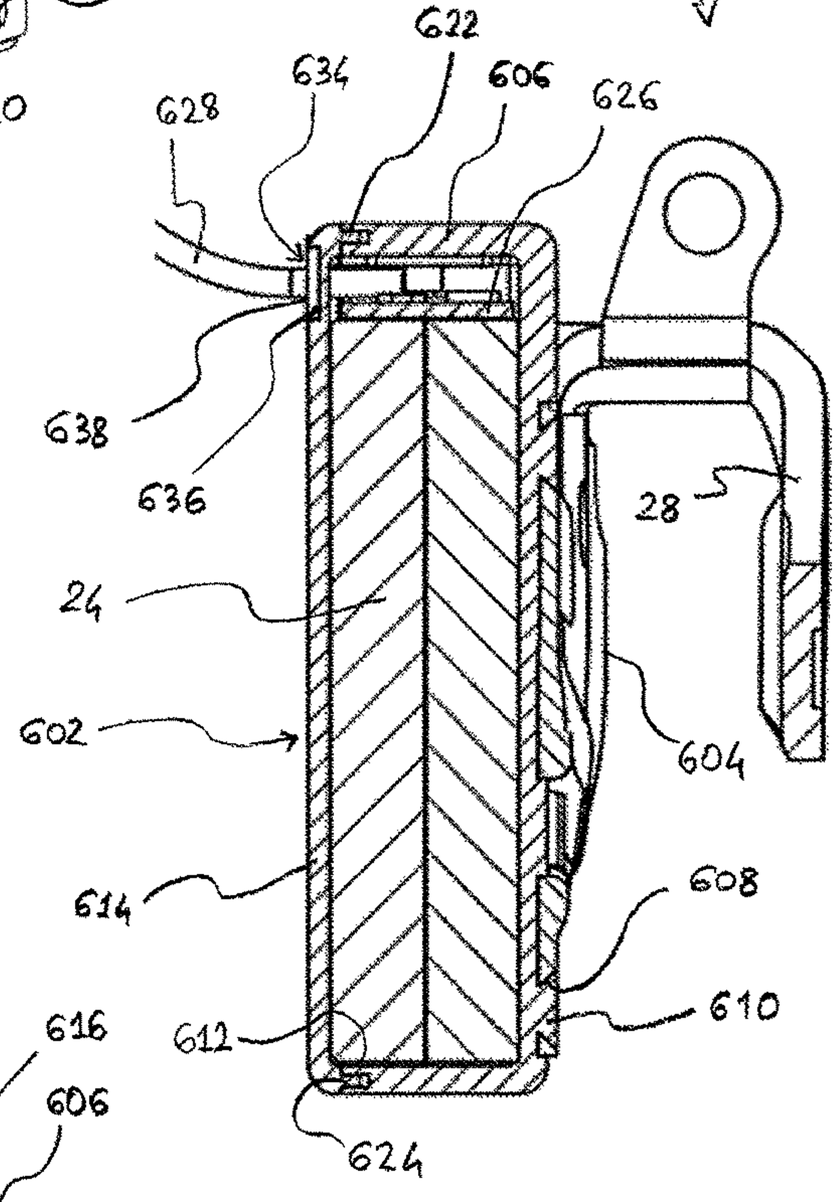

FIG. 14

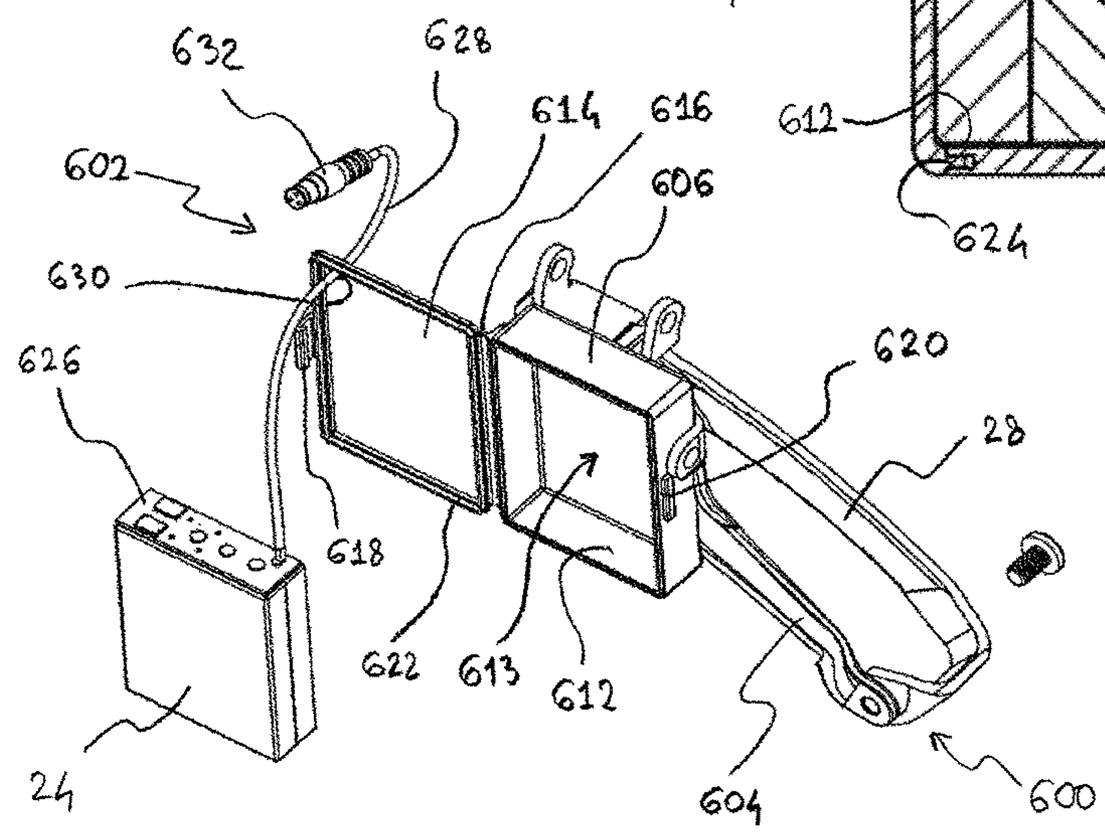

FIG. 15

BICYCLE ELECTRIC FRONT DERAILLEUR

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of Italian Application No. UA2016A004886, filed on Jul. 4, 2016, which is incorporated herein by reference as if fully set forth.

FIELD OF INVENTION

The present invention relates to a bicycle electric front derailleur of an electronically servo-assisted gearshift—hereinafter briefly called electronic gearshift—and in particular to a front derailleur provided with its own power supply battery.

BACKGROUND

With reference to FIG. **1**, a motion transmission system in a bicycle **1100** comprises a chain **1101** extending between toothed wheels **1102**, **1103** associated with the axle of the pedal cranks **1104** and with the hub **1105** of the rear wheel **1106**. When—as in the case shown—there is an assembly of toothed wheels **1102**, **1103** comprising more than one toothed wheel **1102**, **1103** at at least one of the axle of the pedal cranks **1104** and the hub **1105** of the rear wheel **1106**, and the motion transmission system is therefore provided with a gearshift **1110**, a front derailleur **1111** and/or a rear derailleur **1112** are provided for.

In case of an electronic gearshift, each derailleur **1111**, **1112** comprises a guide element **1113**, **1114**—also known as chain guide or cage or, in case of a rear derailleur, rocker arm—movable to displace the chain **1101** among the toothed wheels **1102**, **1103** in order to change the gear ratio, and an electromechanical actuator to displace the chain guide **1113**, **1114**.

Each actuator in turn typically comprises a motor, typically an electric motor, coupled with the chain guide **1113**, **1114** through a linkage, such as an articulated parallelogram, a rack system or a worm screw system. Typically, the electric motor is provided with a gear reduction assembly. The assembly of electric motor and gear reduction assembly is referred to hereinafter as motor gear (or geared motor). The actuator typically further comprises a sensor or transducer of the position, speed, acceleration and/or direction of rotation of the rotor of the motor, or of any moving part downstream of the rotor, down to the chain guide **1113**, **1114** itself. It is worthwhile noting that slightly different terminology from that used in this context is also in use.

Control electronics changes the gear ratio automatically, for example based on one or more detected variables, such as the travel speed, the cadence of rotation of the pedal cranks, the torque applied to the pedal cranks, the slope of the travel terrain, the heart rate of the cyclist and similar, and/or the gear ratio is changed based on commands manually input by the cyclist through suitable control members, for example levers and/or buttons, typically provided on one or two manual command devices **1107** mounted to the handlebars **1108** of the bicycle **1100**.

Typically, the derailleur **1111**, **1112** includes a support body **1118**, **1119** that is configured to be attached to the frame of bicycle **1100**, and the chain guide **1113**, **1114** connected to the support body **1118**, **1119** by means of two connecting rods, the ends of which are articulated to the support body **1118**, **1119** and to the chain guide **1113**, **1114** to form said articulated parallelogram **1116**.

The motor gear drives the articulated parallelogram open and closed, and as a consequence the displacement of the chain guide **1113**, **1114** among the toothed wheels **1102**, **1103**.

In some known electronic gearshifts there is a central battery power supply unit, shared by all of the components of the gearshift **1110**, and typically arranged in a fairly central position on the frame of the bicycle **1100**.

In other electronic gearshifts, there is a battery power supply unit dedicated to the front derailleur (as well as one or more other battery power supply unit(s) dedicated to the other components of the gearshift). In such cases, the battery power supply unit is typically supported on the frame of the bicycle **1100** close to the support body **1118** of the front derailleur **1111**, or on the support body **1118** itself of the front derailleur **1111**.

Indeed, in the field of bicycle components it has always been considered that the linkage of the derailleur should move a load that is as light as possible, so as not to require particularly large sizing and high strength and, in the case of an electronic gearshift, so as to be able to use the smallest possible electric motor.

Furthermore, in the field of bicycle components it has always been considered suitable to keep electrical power consumption as low as possible in order to allow the maximum possible autonomy far from the electrical mains.

The Applicant, solving the technical problem of providing a bicycle electric front derailleur that has an alternative configuration, has now overcome these prejudices of the prior art.

SUMMARY

The invention relates to a bicycle electric front derailleur including a support body that is configured to be attached to a bicycle frame, a chain guide connected to the support body through a linkage, an electric motor that drives the linkage to displace the chain guide among toothed wheels of a motion transmission system, and a battery power supply unit supported by the chain guide.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the present invention will become clearer from the following detailed description of some preferred embodiments thereof, made with reference to the attached drawings. The different features illustrated and described with reference to the single configurations can be combined with each other as desired. In the following description, to illustrate the figures identical or similar reference numerals are used to indicate constructive or functional elements with the same function or analogous function. In the drawings:

FIG. **1**, already described in detail, is a side view of a bicycle equipped with an electronic gearshift according to the prior art,

FIGS. **2** and **3** are perspective views of an electric front derailleur according to a first embodiment of the invention,

FIG. **4** is a partially exploded view illustrating a chain guide, a power supply unit, and some other components of a bicycle electric front derailleur according to the first embodiment of the invention,

FIG. **5** is an exploded view of the electric front derailleur according to the first embodiment,

FIG. **6** is a partially exploded view of components housed within a support body of the derailleur according to the first embodiment,

FIGS. **7** and **8** illustrate a chain guide, a container that houses, among other things, the power supply unit, and some other components of a bicycle electric front derailleur according to a second embodiment of the invention, in two distinct mutual relationships,

FIG. **9** illustrates a partial cross-section through the components shown in FIGS. **7** and **8**, taken along line IX-IX of FIG. **7**,

FIG. **10** illustrates a cross-section analogous to FIG. **9**, in a different mutual relationship of the components,

FIG. **11** is a partially exploded view illustrating a chain guide, a power supply unit, and some other components of a bicycle electric front derailleur according to a third embodiment of the invention,

FIG. **12** is a partially exploded view illustrating a chain guide, a power supply unit, and some other components of a bicycle electric front derailleur according to a fourth embodiment of the invention, and

FIGS. **13-15** illustrate a chain guide, a power supply unit, and some other components of a bicycle electric front derailleur according to a fifth embodiment of the invention, wherein FIGS. **13** and **15** are perspective views of the components in two distinct mutual relationships, and

FIG. **14** illustrates a partial cross-section taken along line XIV-XIV of FIG. **13**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In one aspect, the invention relates to an electric front derailleur of a bicycle, comprising a support body that is configured to be attached to a frame of the bicycle, a chain guide connected to the support body through a linkage, an electric motor that drives the linkage to displace the chain guide among toothed wheels of a motion transmission system, and a battery power supply unit, wherein the battery power supply unit is supported by the chain guide

With such a configuration, the battery power supply unit can be easier to be accessed and replaced, and the removal thereof from the bicycle can take place without having to disassemble the derailleur.

Furthermore, the battery power supply unit stabilizes the chain guide increasing the inertia thereof, so that it better tolerates vibrations.

Preferably, the battery power supply unit is provided for supplying power to the electric motor and/or to at least some electric or electronic components of the derailleur.

Typically, a driving circuit of the electric motor, a control circuit of the derailleur, a communication circuit with the remaining components of an electronic gearshift of a bicycle, etc., are provided among the electronic components of the derailleur.

Preferably, the battery power supply unit is housed within a container.

More preferably, the container housing the battery power supply unit is removably supported by the chain guide.

In the present description and in the attached claims, under "removably" it is meant to indicate that it is possible to disconnect two components without breaking or damaging them.

The container can be screwed onto the chain guide.

Alternatively, the container can be held on the chain guide by means of at least one holding device.

In other embodiments, the container comprises a portion for the battery power supply unit that is fixedly supported by the chain guide.

In the present description and in the attached claims, under "fixedly" it is meant to indicate that it is not possible to disconnect two components without breaking or damaging them.

Preferably, the housing portion of the container is made in one piece with the chain guide.

Even more preferably, the housing portion of the container is co-molded with the chain guide.

Alternatively, the housing portion of the container could for example be welded or glued to the chain guide.

Preferably, the housing portion of the container is provided with an opening for the insertion and removal, respectively, of the battery power supply unit, a door being provided for closing the opening.

More preferably, the door for closing the opening is made in one piece, even more preferably co-molded, with the housing portion.

Alternatively, the door could be fixed, for example welded or glued, to the housing portion, or it could be removably constrained to the housing portion, for example screwed.

Preferably, the chain guide comprises an inner plate and an outer plate, and the battery power supply unit is supported by the inner plate.

In the present description and in the attached claims, under "inner" it is meant to indicate the side closest to the frame of the bicycle in the mounted condition of the derailleur, while under "outer" it is meant to indicate the side furthest from the frame of the bicycle in the mounted condition of the derailleur.

In this way, it is better protected from collisions, and less visible. Furthermore, it is housed between the chain guide and the frame of the bicycle, and therefore has a smaller actual bulk and less aerodynamic impact.

In the case described above of the container comprising a portion for housing the battery power supply unit that is fixedly supported by the chain guide, the opening of the housing portion of the container is preferably made on the inner face of the housing portion of the container.

In this way, the opening of the housing portion of the container can be easily accessed for the insertion and removal, respectively, of the battery power supply unit.

Alternatively or in addition, the opening and the related door could be made on another face of the container, for example on the bottom face of the housing portion of the container, which is opposite the (upper) face of the container that faces towards the support body.

Alternatively, the battery power supply unit can be supported by the outer plate, so as to be easier to be accessed.

The derailleur preferably comprises a management circuit of the battery power supply unit.

The battery power supply unit and the related management circuit form a so-called smart battery.

Preferably, the management circuit is housed within the same container as the battery power supply unit, so as to detect, e.g. the instantaneous temperature, in an optimal manner.

More preferably, the management circuit is housed within a same inner chamber of the container as the battery power supply unit, so as to advantageously be in close contact therewith.

Alternatively, the battery power supply unit is housed within a main inner chamber of the container, and the management circuit is housed within a secondary inner chamber of the container.

The derailleur preferably further comprises a recharging circuit for providing a recharge voltage and/or current of an intensity controlled over time to the battery power supply unit.

The recharging circuit can be supported by the support body.

In this case, preferably the recharging circuit is supported by a same printed circuit board on which a driving circuit of the electric motor is supported.

Alternatively, the recharging circuit can be supported by the chain guide.

In this case, the recharging circuit is preferably housed in within the same container as the battery power supply unit.

More preferably, the battery power supply unit is housed within a main inner chamber of the container, and the recharging circuit is housed within a or the secondary inner chamber of the container, respectively.

Preferably, the secondary inner chamber of the container is formed in an appendage of the container that extends along the chain guide, more preferably along the inner plate of the chain guide.

In this way, the appendage has the least possible aesthetic and aerodynamic impact.

Typically, the motor is coupled with a gear reduction mechanism to form a motor gear.

The gear reduction mechanism typically comprises a gear train.

Preferably, the motor and/or at least part of the electrical/electronic components powered by the battery power supply unit are fixedly supported on the support body.

In this case, preferably a flexible cable connects the container housing the battery power supply unit and the support body.

Such a power supply cable need only to allow the short stroke of the chain guide, of the order of one centimeter.

More preferably, the flexible cable terminates with a removable connector, and a matching removable connector is provided on the support body, so as to be able to detach the electrical connection, for example for long periods of inactivity.

As an alternative to removable connectors, between the battery power supply unit and the motor gear and/or the electronics powered by it, a fixed electrical connection can be provided, or a sliding contact can be provided.

Preferably, a recharging port is provided for the removable connection of the battery power supply unit to the electrical mains through a cable or a recharging device provided with a matching connector.

In embodiments, the recharging port is fixedly supported on the support body.

In other embodiments, the recharging port is supported by the chain guide.

Preferably, the recharging port faces an opening of a container.

More preferably, the container from which the recharging port faces is the one that houses the recharging circuit.

Preferably, the recharging port is of the USB type.

Preferably, the derailleur comprises a cover for protecting the recharging port when the cable or recharging device is not present.

More preferably, the cover is removable and replaceable.

Preferably, furthermore, the cover is flexible.

Even more preferably, the flexible cover is engageable on a small nail fixed to the derailleur, through elastic deformation of a holed sleeve of the flexible cover.

Preferably, the derailleur comprises a wireless communication circuit for the communication of data and commands with other components of a bicycle electronic gearshift.

Preferably, the wireless communication circuit and the recharging circuit are housed on a same printed circuit board.

Preferably, as stated, the derailleur comprises a driving circuit of the electric motor.

Preferably, the driving circuit of the electric motor is fixedly supported on the support body.

Preferably, the driving circuit and the recharging circuit, and more preferably also the wireless communication circuit, are housed on a same printed circuit board.

Preferably, the derailleur comprises a slack recovery spring that biases the chain guide.

By means of such a spring it is possible to keep the chain guide spaced from the chain during the rest condition of the derailleur, avoiding the dragging of the chain on the chain guide, and the associated friction and noise.

More preferably, said spring biases the chain guide towards the frame of the bicycle, differently from the prior art wherein the chain guide is biased away from the frame of the bicycle.

This provision therefore represents an innovative aspect per se, also in an electric derailleur—front or even rear—that does not have some of the features indicated above and/or in the rest of the description.

Typically, the linkage includes two connecting rods, the opposite ends of each of which are articulated to the support body and to the chain guide, to form an articulated parallelogram.

Preferably, an output shaft of the electric motor or of the motor gear coincides with an articulation pin of the articulated parallelogram linkage.

More preferably, a pin extending from one of the connecting rods engages in a hole formed at one end of the output shaft.

Preferably, furthermore, a second end of the output shaft of the electric motor or of the motor gear engages in a hole formed in said one of the connecting rods.

This configuration of the articulated parallelogram represents an innovative aspect per se, also in an electric derailleur—front or even rear—that does not have some of the features indicated above and/or in the rest of the description.

Alternatively, the electric motor is arranged along the diagonal of the articulated parallelogram.

Referring now to FIGS. **2-4**, an electric front derailleur **10** of an electronic gearshift according to a first embodiment of the invention is disclosed.

The electric front derailleur **10** generally comprises a support body **12** configured to be attached to the frame of the bicycle **1100** through means generically indicated with **13** and better described hereinafter, a chain guide **14**, and a linkage **16** that connects the chain guide **14** to the support body **12** so that it is displaceable among the toothed wheels **1102** associated with the axle of the pedal cranks **1104** of the motion transmission system of the bicycle **1100**.

In the case shown, the chain guide **14** is connected to the support body **12** by means of two connecting rods or arms **18**, **20**, each articulated, at opposite ends, to the support body **12** and to the chain guide **14**, respectively. In the case shown, the linkage **16** is therefore an articulated parallelogram.

The linkage **16** is commanded by means of a motor gear (visible in FIG. **5** with reference numeral **22**). Linkage **16** and motor gear **22** form an electromechanical actuator of the derailleur **10**.

The electric front derailleur **10** further comprises a battery power supply unit **24** to provide the necessary power supply to the electric motor of the motor gear **22** and/or to a driving circuit thereof, and/or to other electrical/electronic components of the derailleur **10** itself.

Preferably, such electrical/electronic components of the derailleur **10** include a communication circuit for communicating data and commands with other components of the bicycle electronic gearshift of which the electric front derailleur **10** is part, in particular for receiving gearshifting request signals from manual command devices **1107**.

Preferably, the communication circuit is of the wireless type, for example according to Bluetooth® protocol.

Preferably, such electrical/electronic components of the derailleur **10** further include a microcontroller for supervising the various aforementioned circuits.

When in particular the battery power supply unit **24** also powers the electric motor of the motor gear **22**, and furthermore the communication circuit is wireless, the electric front derailleur **10** is advantageously stand-alone, and it is not necessary to provide any data/power supply connection cable with the rest of the electronic gearshift.

Furthermore, there can be a sensor or transducer of the position, speed, acceleration and/or direction of rotation of the rotor of the motor of the motor gear **22** or of any moving part downstream of the rotor, down to the chain guide **14** itself, to verify when the intended position has been reached by the chain guide **14**, or more generally to provide feedback on the position of the chain guide **14** during use of the electronic gearshift.

The battery power supply unit **24** can for example be a lithium ion battery.

According to the invention, the battery power supply unit **24** is supported by the chain guide **14**.

More specifically and with reference to FIG. **4**, the chain guide **14** comprises an inner plate **26** and an outer plate **28** spaced apart so as to form a gap **30** in which the chain **1101** extends.

In the embodiment shown, the battery power supply unit **24** is supported by the inner plate **26** of the chain guide **14**. In this way, it is better protected from collisions, and less visible. Furthermore, in the mounted condition of the derailleur **10**, the battery power supply unit **24** is housed between the chain guide **14** and the frame of the bicycle **1100**, and therefore has a smaller actual bulk and less aerodynamic impact.

Preferably, the chain guide **14** supports the battery power supply unit **24** in a removable manner. The removability, in this embodiment, is obtained through screwing.

In particular, the battery power supply unit **24** is housed within a container **32** formed by two portions **34**, **36** that, in the present embodiment, are joined together and fixed to the chain guide **14** by means of a first screw **38** extending in an unthreaded hole **40** of the chain guide **14**, in an unthreaded hole **42** of the portion **34**, and screwed into a threaded hole **44** of the portion **36**, as well as by means of a second screw **46** extending in an unthreaded hole **48** of the chain guide **14**, and screwed into a threaded hole **50** of the portion **36**. The second screw **46** does not pass through the first portion **34** of the container **32**, but this would of course be possible.

The unthreaded hole **42** of the portion **34** of the container **32** is formed in a lug **52** projecting laterally with respect to an inner chamber **54** of the container **32**, and the threaded holes **44**, **50** of the portion **36** of the container **32** are formed in lugs **56**, **58** projecting laterally with respect to the inner chamber **54** of the container **32**.

In the embodiment discussed here, the container **32** houses, within the chamber **54**, besides the battery power supply unit **24**, a printed circuit board **60** (PCB).

The board **60** in particular houses components that embody a management circuit of the battery power supply unit **24**.

Such a management circuit, per se known, typically includes a temperature sensor, and emits an alarm signal when the temperature goes outside of a predetermined range of temperatures and/or an approval signal for recharging and/or for use when the temperature falls within one or a respective predetermined temperature range. Alternatively and/or in addition, such a management circuit can monitor the voltage and/or the current of the cell(s) forming the battery power supply unit **24**, emitting an alarm signal in case the values go outside predetermined ranges. The alarm signal can lead to the electrical insulation of the battery power supply unit **24** from the rest of the electric circuit, so as to safeguard the relative components thereof, also respecting current regulations. Furthermore, the management circuit can monitor the residual charge, take the charging cycles into account, etcetera.

The battery power supply unit **24** and the management circuit made on the board **60** form a so-called smart battery.

The arrangement of the board **60** carrying the management circuit in the same chamber **54** as the battery power supply unit **24**, and in particular in close contact therewith, is advantageous because the temperature detected by the temperature sensor provides an accurate indication of the instantaneous temperature of the battery power supply unit **24** itself.

The board **60** is electrically connected to the electrical contacts (not shown) of the battery power supply unit **24** by means of welded cables **64**.

Alternatively, the electrical connection between the battery power supply unit **24** and the board **60** could take place through spring contacts.

The management circuit and the possible other circuits made on the board **60** are furthermore connected to a three-conductor cable **66** that extends from the board **60** and comes out from the container **32** through an opening **68**, made for example at the lug **56** of the portion **36** thereof. A flexible sheath **70** is preferably provided at the opening **68**.

During use of the electronic gearshift, the three-conductor cable **66** carries the power supply from the battery power supply unit **24** to the users, and in particular to the motor gear **22**, which in the embodiment shown is housed in the support body **12**. The three-conductor cable **66** also carries the power supply for recharging the battery power supply unit **24**. Furthermore, the three-conductor cable **66** carries data signals that are exchanged between the smart battery formed of the battery power supply unit **24** and the management circuit thereof, and the remaining electrical/electronic components housed in the support body **12**, for example information on the detected temperature or on the residual charge of the smart battery.

The three-conductor cable **66** therefore extends up to the support body **12**, and is sufficiently flexible and long as to allow the short stroke of the chain guide **14** in its movement among the toothed wheels **1102**.

Inside the support body **12**, the three-conductor cable **66** is electrically connected, in the manner better described hereinafter, to the motor gear **22** and/or to the other users and circuits.

Furthermore, at the support body **12**, the three-conductor cable **66** is electrically connected to a recharging port **72** (FIG. **5**) faced at the support body **12**—at an opening that is

not visible—for the removable connection of the battery power supply unit **24** to the electrical mains through a cable or a recharging device (not shown) provided with a matching connector.

The recharging port **72** is preferably of the USB type.

The electric front derailleur **10** preferably comprises a recharging circuit for supplying a voltage or a current that is controlled over time—derived from the mains voltage received through the recharging port **72**—to the battery of the battery power supply unit **24** during recharging from the electrical mains.

As illustrated more clearly in FIG. **5**, a protective cover **74** is preferably provided to protect the recharging port **72** when the cable or recharging device is not connected thereto.

The protective cover **74** preferably has a fake connector **76** matching the recharging port **72**, so as to engage stably thereonto.

Advantageously, the protective cover **74** is made of flexible material, and is provided with a holed sleeve **78** to receive a small nail **80** projecting from the support body **12**.

In this way, the protective cover **74** is easily removable—and therefore replaceable—through elastic deformation of the holed sleeve **78**, and can remain attached to the support body **12** also when the recharging port **72** is uncovered for use.

Now with reference in particular to FIGS. **5** and **6**, the electric front derailleur **10** of the first embodiment is described in greater detail, it being understood that such details are provided merely as a non-limiting example.

A casing of the support body **12** is made of two casing portions **82**, **84** suitably constrained to each other, for example by thermowelding, ultrasound welding, sealing, gluing, etc.

The aforementioned means **13** for fixing the support body **12** to the frame of the bicycle **1100** are exemplified through a bolt formed of a screw **86** and a nut **87**. The screw **86** is screwed into a hole **88** of an insert **89** that fixes to the first casing portion **82**, for example through a pin **90**.

The attachment to the bicycle takes place by clamping the bolt **86**, **87** at a through hole of the frame of the bicycle—in particular of the seat post tube—extending along the travel direction. The support body **12** seats between the seat post tube and the rear wheel, so that the chain guide **14** is correctly in position with respect to the toothed wheels **1102**.

In such a mounted configuration, the container **32** housing the battery power supply unit **24** is arranged between the chain guide **14** and the frame of the bicycle, advantageously protected, hidden, and having little aerodynamic impact.

Preferably, a contact plate **91** is also provided, arranged between the nut **87** and the first casing portion **82**, which during mounting is arranged between the nut **87** and the seat post tube. The plate **91** preferably has a cylindrical face contacting the seat post tube and a partially flat face contacting the nut **87**.

The linkage **16** that connects the chain guide **14** in a displaceable manner with respect to the support body **12** is formed, as stated, by an articulated parallelogram that comprises the two connecting rods **18**, **20**, each articulated, at opposite ends, to the support body **12** and to the chain guide **14**, respectively.

More specifically, the inner connecting rod **18** is coupled with the support body **12** in a pivotal manner about a rotation axis X defined by an idle pin **92**, and is coupled with the chain guide **14** in a pivotal manner about a rotation axis Y defined by a pair of coaxial idle pins **94**.

The outer connecting rod **20** is coupled with the support body **12** in a pivotal manner about a rotation axis W defined in the manner better specified hereinafter, and is coupled with the chain guide **14** in a pivotal manner about a rotation axis Z defined by a pin **98**.

The inner connecting rod **18** is generically horseshoe shaped, defined by a cross member **100** and by legs **102**, **104**.

The idle pin **92** defining the rotation axis X extends through an unthreaded hole **106** formed at the first end of the inner connecting rod **18** close to the leg **102**, through an unthreaded hole **108** formed in the second casing portion **84**, through an unthreaded hole **110** formed at the first end of the inner connecting rod **18** close to the leg **104**, and is screwed into an internally threaded sleeve **111** formed on the insert **89**. The holes **106**, **110** of the inner connecting rod **18** are formed in particular in respective lugs **112** projecting from the cross member **110** on the opposite side with respect to the legs **102**, **104**.

The pair of idle pins **94** defining the rotation axis Y each extend through an unthreaded hole **114** formed at the second end of the inner connecting rod **18**, and through an unthreaded hole **116** formed at the chain guide **14**, and are axially held by a respective Seeger ring **118**. The unthreaded holes **114** are formed in particular at the free end of each leg **102**, **104**. The unthreaded holes **116** are formed in particular on ears **120** of the inner plate **26** of the chain guide **14**, more clearly visible in FIG. **4**.

The outer connecting rod **20** is made in two pieces **122**, **124**, joined together as if they were a single piece, preferably through a pin-type coupling **126**, and also is generically U-shaped.

The idle pin **98** defining the rotation axis Z extends through an unthreaded hole **128** formed at the second end of the outer connecting rod **20**, with interposition of a bushing **130**, and through unthreaded holes **132** formed at the chain guide **14**, and is axially held by a Seeger ring **134**. The unthreaded hole **128** is formed in particular through the first piece **122** only of the outer connecting rod **20**.

The unthreaded holes **132** are formed in particular on ears **136**, **138** of the inner plate **26** of the chain guide **14**.

In greater detail and as can be seen more clearly in FIG. **4**, the inner plate **26** and the outer plate **28** of the chain guide have portions **140**, **142** bent towards one another and overlapped, which are joined together by a rivet **144** extending in suitable aligned holes, only one of which holes is visible and indicated with reference numeral **146**; furthermore, the outer plate **28** has a second portion **148** bent towards the inner plate **26** and joined thereto through a screw **150** extending in suitable aligned holes, only one of which holes is visible and indicated with reference numeral **152**.

The aforementioned ears **136**, **138** extend from the bent portion **140** of the inner plate **26**. Preferably, the ear **136** passes through a suitable opening **154** of the bent portion **142** of the outer plate **28**, so as to contribute to fixing together the plates **26**, **28** of the chain guide **14**.

The inner plate **26** of the chain guide **14** preferably has one or more apertures **156** (two of which are shown as an example). Such apertures **156** allow the chain guide **14** to be made lighter, and prevent the accumulation of grease and dirt between the plates **26**, **28** of the chain guide **14**. Furthermore, when formed at the area where the chain guide **14** supports the container **32**, they allow to facilitate the cooling of the battery power supply unit **24**, and to facilitate the removal of the container **32** for any reason, by pushing it from behind with the finger.

The outer plate **28** of the chain guide **14** also preferably has one or more apertures **158** (three of which are shown as

an example, visible in FIGS. **2**, **5**), which allow the chain guide **14** to be made lighter, and avoid the accumulation of grease and dirt.

The legs **102**, **104** of the inner connecting rod **18** also preferably have apertures, one of which is visible and indicated with reference numeral **103**.

Going back to FIG. **5**, the rotation axis W of the outer connecting rod **20** about the support body **12** is defined by an output shaft **160** of the motor gear **22**. In this way, the outer connecting rod **20** is driven in rotation by the motor gear **22**, so that the articulated parallelogram linkage and the motor gear **22** embody the electromechanical actuator.

In greater detail, on the side, an end of the output shaft **160** of the motor gear **22** engages in a hole **162** formed in the portion **122** of the outer connecting rod **20**; on the other side, a pin **164** extending from the portion **124** of the outer connecting rod **20** engages in a hole (not shown) formed in the other end of the output shaft **160**.

This configuration of the articulated parallelogram is particularly advantageous and represents an innovative aspect per se, that may be used in any front or rear derailleur, irrespective of how the battery power supply unit **24** is supported.

Still in greater detail, the casing portions **82**, **84** of the support body **12** define an inner chamber **168** and a framework **170** is housed within the inner chamber **168**.

As better shown in FIG. **6**, the framework **170** supports the motor gear **22** and has two holes, only one of which is visible and indicated with reference numeral **172**, at the two ends of the output shaft **160** of the motor gear **22**. The end of the shaft **160** projects through the hole **172**, while the pin **164** of the outer connecting rod **20** penetrates in the shaft **160** through the hole that is not shown.

Advantageously, the framework **170** also supports a second printed circuit board **176**. The second board **176** supports the recharging port **72** described above.

Preferably, the second board **176** also supports the recharging circuit described above.

Furthermore, advantageously the same second board **176** supports some of the electrical and electronic components described above, such as the communication circuit—advantageously wire less—with the rest of the electronic gearshift, the feedback sensor, the microcontroller, etc.

Three conductors, globally indicated with reference numeral **178**, which electrically correspond to the three conductors of the three-conductor cable **66** of the battery power supply unit **24**, and that therefore carry the power supply to and from the battery power supply unit **24**, and the data from and to its management circuit described above, extend from the second board **176**.

Advantageously, the framework **170** further supports a third printed circuit board **180**. The third board **180** preferably supports the driving circuit of the motor gear **22**. Alternatively or in addition, the third board **180** preferably supports one or more sensors for controlling the motor gear **22** and/or other components and circuits.

Between the second board **176** and the third board **180** five conductors extend, wholly globally indicated with reference numeral **182**, which carry the power supply and the data to and from the third board **180**, in particular to the driving circuit of the motor gear **22**.

Two conductors, globally indicated with reference numeral **184**, which carry the power supply to the motor gear **22**, also extend from the second board **176**.

The boards **176**, **180**, in the example shown, are mounted on the framework **170** respectively through screws **186**, **188** extending in unthreaded holes **190**, **192** of the boards **176**, **180**, and screwed into holed sleeves **194**, **196** of the framework **170**. Spacers **198** are also shown.

This arrangement of the boards **176**, **180**, even if merely exemplary, allows a suitable aeration, and avoids overheating of the electrical and electronic components despite them being close to the motor gear **22**. Advantageously, the boards **176**, **180** extend in perpendicular planes as shown.

Advantageously, the three conductors **178** that extends from the second board **176** are joined to the corresponding conductors of the three-conductor cable **66** of the battery power supply unit **24** in a removable manner.

In detail, the three conductors **178** are gathered into a removable connector **200** that removably engages with a matching removable connector **202** (FIGS. **2**, **3**, **5**) arranged at the end of the three-conductor cable **66** of the battery power supply unit **24**.

Such a pair of connectors **200**, **202** allows the detachment of the battery power supply unit **24** from the support body **12**, but alternatively the three conductors of cable **66** could be directly connected to the second board **176**, or the conductors **178** and the three conductors of cable **66** could be irremovably connected.

Advantageously, the connector **200** is supported by the third board **180**.

An opening **204** of the support body **12** allows the engagement of the connector **200** with the matching connector **202**.

Advantageously, the opening **204** is formed in a sleeve **206** of the casing portion **84**, so that the interface between the two connectors **200** and **202** is recessed and less exposed to atmospheric agents and to dirt. Furthermore, the sleeve **206** acts as a support for the connector **202** on the side of the chain guide **24**.

A support element **208** of the connector **200** on the side of the three conductors **178** is also provided. Preferably, the support element **208** is slidably engaged on the support body **12**.

According to a particularly advantageous aspect, the electric front derailleur **10** further has a slack recovery spring **210** for the components of the linkage **16**.

In the embodiment shown, the spring **210** is of the torsion type, and is arranged between the support body **12** and the inner connecting rod **18**, about the pin **92** defining the rotation axis X.

Through such a spring **210** it is possible to keep the chain guide **14** spaced from the chain **1101** during the rest condition of the derailleur, avoiding the dragging of the chain **1101** on the chain guide **14** and the associated friction and noise.

A first end of the spring **210** hooks to a pin **212** of the support body **12**, in particular formed on the casing portion **84**. A second end of the spring **210** hooks to the cross member **100** of the inner connecting rod **18**, and is blocked there in a suitable groove **214** and by a small mail **216** extending along the cross member **100**.

The spring **210** is mounted in a preloaded condition and imposes such a rotation onto the inner connecting rod **18** as to pull the chain guide **14** towards the support body **12**.

The spring **210** therefore biases the chain guide **14** towards the frame of the bicycle **1100**, differently from the prior art according to which the chain guide **14** is biased away from the frame of the bicycle **1100**.

The arrangement at the rotation axis X between the inner connecting rod **18** and the support body **12** is preferred since it is the position furthest downstream in the linkage **16** that transmits the motion from the motor gear **22**. However, alternatively, the spring **210** can be arranged further

upstream in the linkage **16**, namely between the inner connecting rod **18** and the chain guide **14**, or between the outer connecting rod **20** and the chain guide **14**.

Such a spring **210** represents an innovative aspect per se, that may be used in any front or rear derailleur, irrespective of how the battery power supply unit **24** is supported.

The motor gear **22** typically comprises an electric motor **218**, and a gear train operatively arranged between a drive shaft **222** of the motor **218** and, the output shaft **160**.

The gear train can for example comprise a plurality of toothed members, engaged in pairs and/or coaxial and co-rotating in pairs and/or a worm screw.

The speed reduction ratio between the drive shaft **22** and the output shaft **160** of the motor gear **22** is given in a per se known way by the number and type of gears used, as well as by parameters like for example the number of teeth of the toothed members of the gear train.

In the case shown, the drive shaft **222** and the output shaft **160** extend perpendicular to each other.

In the motor gear **22** there can be a position sensor, for example a magnetic position encoder.

The distribution of the electrical and electronic components housed in the support body **12** on two printed circuit boards **176**, **180** is not strictly necessary: a single board or vice-versa three or more boards could be provided, the changes to the connections described above being within the capabilities of those skilled in the art in the light, of the above description.

As an alternative to what is described above, the recharging circuit could be housed in the inner chamber **54** of the container **32** housing the battery power supply unit **24**.

Still as an alternative, the recharging port could also be provided facing from the container **32** housing the battery power supply unit **24**.

An embodiment wherein the recharging circuit and the recharging port **72** are housed in the same container as that housing the battery power supply unit **24** is described hereinafter with reference to FIG. **12**.

FIGS. **7-10** show a chain guide **300** of an electric front derailleur according to a second embodiment of the invention, which supports the battery power supply unit **24**. Components that are the same as or similar to those of the first embodiment are not described in detail.

Also in this case the battery power supply unit **24** is removably supported by the chain guide **300**.

In this embodiment, instead of using screwing, two holding devices **302** are used. The chain guide **300** is suitably modified with respect to that of the first embodiment, as is the container **304** housing, among other things, the battery power supply unit **24**.

Also in this case, the battery power supply unit **24** is supported, by means of the container **304**, in particular by the inner plate **306** of the chain guide **300**.

Each holding device **302** comprises a lever **308** hinged onto the inner plate **306** of the chain guide **300**. The lever **308** comprises a holding arm **310** and a driving arm **312**.

The two holding devices **302** are advantageously the same, but mounted rotated by 180° with respect to one another, so as to direct the holding arms of the two holding devices **302** both towards the container **304** housing the battery power supply unit **24**.

The lever **308** is elastically biased towards a condition in which the holding arm **310** rests and pushes onto the inner face of the container **304**, so as to hold the container **304**—and therefore the battery power supply unit **24** housed therein—in position against movement away in the direction perpendicular to the main plane of the inner plate **306**, namely in the inward direction.

FIGS. **7-9** show the stable state of the two holding devices **302**, wherein in FIGS. **7** and **9** the container **304** housing among other things the battery power supply unit **24** is seated and held on the chain guide **300**, while in FIG. **8** the container **304** is completely separate from the chain guide **300**. FIG. **10** shows the unstable state of the two holding devices **302**, during pressing with the fingers on the driving arms **312**, with the container **304** seated on the chain guide **300** even if not held, in a release or fastening step.

In greater detail, in the exemplary embodiment shown, the lever **308** is pivoted on a pin **314** extending between and supported by a pair of ears **316** projecting from the inner plate **306** of the chain guide **300**, from its inner face, namely from its face opposite the gap **30** for receiving the chain **1101**.

A return spring **318** is operatively arranged between the lever **308** and the chain guide **300** to provide the aforementioned elastic bias. For example, the spring **318** is a helical torsion spring arranged around the articulation pin **314** of the lever **308**. A first end of the spring **318** is hooked to a second pin **320** supported by the lever **308**, and a second end of the spring **318** is hooked to a third pin **322** extending between and supported by the ears **316**. The second pin **320** is only visible in the left holding device **302** in FIGS. **7-10**, while the third pin **322** is only visible in the right holding device **302** in FIGS. **7-10**.

Preferably, the holding arm **310** of each lever **308** is configured to look into a respective hooking seat **324** formed on the container **304**, so as to hold the container **304** and therefore the battery power supply unit **24** in position against the displacement in at least one direction parallel to the main plane of the inner plate **306**.

The holding arm **310** for this purpose has a groove **326** in which a rib **328** formed in the fastening seat **324** of the container engages, and a rib **330** that engages in a groove **332** formed on the hooking seat **324** of the container **304**, so as to hold the container **304** and therefore the battery power supply unit **24** in position against the displacement in a first direction parallel to the main plane of the inner plate **306**, namely the direction perpendicular to the direction of the grooves and ribs **326**, **328**, **330**, **332**.

Preferably, the hooking seat **324** of the container **304** has an abutment shoulder **334** at at least one end of the groove **332**, so as to hold the container **304** and therefore the battery power supply unit **24** in position against the displacement in at least one direction in a second direction parallel to the main plane of the inner plate **306**, perpendicular to the first direction. In the embodiment shown, the hooking seat **324** on the right of the container **304** has only one shoulder **334**, while the hooking seat **324** on the left of the container **304** has two shoulders.

The container **304** also has a further hooking seat **336**, which is not used in the embodiment shown, but which can be exploited for attaching another component.

The driving arm **312** of the lever **308** of each holding device **302** has a substantially planar shape, and preferably projecting laterally outside of the space delimited by the ears **316** supporting the articulation pin **314** of the lever **308**.

Preferably, the driving arm **312** widens in the laterally outer region outside of the space delimited by the ears **316**, in order to increase the surface to facilitate pressing with a finger.

The driving arm **312**, even more preferably, has an asymmetrical shape, widening on only one side to take up a generic L-shape. The driving arms **312** thus open out one

upwards (the left one in FIGS. **7-10**) and the other downwards (the right one in FIGS. **7-10**), with reference to the mounted condition.

The chain guide **300** otherwise corresponds to the chain guide **14** described with reference to the first embodiment, except that the holes **40** and **48** are missing, as are the screws **38** and **46**.

The container **304** otherwise corresponds to the container **32** described with reference to the first embodiment, except that the lugs **52**, **56**, **58** are absent.

It will easily be understood that it is possible, alternatively, to make grooves and ribs in the holding arm **310** of the lever **308** and in the hooking seat **324** on the container **304** that are not rectilinear, with which to hold the battery power supply unit **24** in position against the displacement in all directions parallel to the main plane of the inner plate **306**.

Alternatively or in addition to the hook like configuration of the holding arm **310** of the lever **308** of the holding devices **302**, it is possible to provide, on the chain guide, a recessed seat for the container in which the battery power supply unit **24** is housed, for example by bending one or more edges of the inner plate **306** of the chain guide **300** to form a respective abutment shoulder, so as to limit at least in part the movement of the container **304** in the directions parallel to the main plane of the inner plate **306**. In particular, since in an operative condition such a plane is vertical, it may be suitable to provide a shoulder along at least one section of the edge of the inner plate **306** that is lowermost in use.

Furthermore, it will be understood that the movement of the container **304** in the directions parallel to the main plane of the inner plate **306** can also be limited through a pin coupling made between the inner face of the inner plate **306** of the chain guide **300** and the face of the container **304** facing thereto in a mounted condition (the one not visible in FIGS. **7** and **8**).

The number of holding devices **302** could vary, a single holding device **302** or, for example, three or four holding devices **302** being provided, arranged at the sides of the container **304**. In the case of a single holding device **302**, on the side opposite thereto, a holding edge will for example be made through bending of the inner plate **306** of the chain guide **300**.

FIG. **11** illustrates the chain guide of an electric front derailleur according to a third embodiment of the invention, which supports the battery power supply unit **24**. Components that are the same as or similar to those of the first embodiment are not described in detail.

In this embodiment, the chain guide is unchanged and is again indicated with reference numeral **14**, while the change concerns the container **400** and the components housed thereinto, including the battery power supply unit **24**.

Therefore, similarly to what has been described for the first embodiment of the invention, also in this case the battery power supply unit **24** is removably supported by the chain guide **14**, in particular screwed thereto.

Also in this case, the battery power supply unit **24** is supported, through the container **400**, in particular by the inner plate **26** of the chain guide **14**.

Each of two container portions **402**, **404** has a main region, **406** and **408** respectively, and an appendage, **410** and **412** respectively. The main regions **406**, **408** define a main inner chamber **414** of the container **400** adapted for housing the battery power supply unit **24**.

The appendages **410**, **412** advantageously define a secondary inner chamber **416**, which provides an additional space for housing electronic components.

In the secondary inner chamber **416**, a printed circuit board **418** is housed.

The board **418** carries the management circuit of the battery power supply unit **24**, which similarly to the first embodiment is connected to the terminals of the battery power supply unit **24**, to form a so-called smart battery.

The inner chambers **414**, **416** communicate with each other, so as to allow the passage of the cables **420**.

The management circuit made on the board **418** is connected to a three-conductor cable **422** that extends from the board **418** and comes out from the container **400** in a manner totally analogous to the first embodiment.

The three-conductor cable **422** is also preferably provided with a connector **424**, corresponding to the connector **202** of the first embodiment.

Advantageously, the appendage of the container **400**, formed by the appendages **410**, **412** of the container portions **402**, **404**, extends obliquely from the main region of the container **400**, formed by the main regions **406**, **408** of the container portions **402**, **404**, so as to extend along the inner plate **26** of the chain guide **14**. With such an arrangement, the appendage of the container **400** is hidden from view and protected from collisions by the chain guide **14** besides, as well as having the least possible aerodynamic impact.

The board **418** can furthermore carry the recharging circuit of the battery power supply unit **24**, which in this case will be absent from the board **176** housed in the support body **12**, the changes to the electrical connections being manifest to those skilled in the art in the light of the present description.

It should be understood that the configuration of the container **400** with the appendage defining the secondary inner chamber **416** of the third embodiment can also be used in the case of a container supported by one or more holding devices **302** as described above with reference to the chain guide **300** of the second embodiment, the changes to be made to the container **400** being manifest to those skilled in the art in the light of the present description.

FIG. **12** illustrates the chain guide of an electric front derailleur according to a fourth embodiment of the invention, which supports the battery power supply unit **24**. Components that are the same as or similar to those of the first or of the third embodiment are not described in detail.

Also in this embodiment, the chain guide is unchanged and is again indicated with reference numeral **14**, while the change concerns the container **500** and the components housed thereinto, including the battery power supply unit **24**.

Therefore, similarly to what was described for the first and, the third embodiment of the invention, also in this case the battery power supply unit **24** is removably supported by the chain guide **14**, in particular screwed thereto.

Also in this case, the battery power supply unit **24** is supported, through the container **500**, in particular by the inner plate **26** of the chain guide **14**.

Also in this embodiment, like in the third embodiment described above, each of two container portions **502**, **504** has a main region, **506** and **508** respectively, and an appendage, **510** and **512** respectively. The main regions **506**, **508** define a main inner chamber **514** of the container **500**, adapted for housing the battery power supply unit **24**. The appendages **510**, **512** define a secondary inner chamber **516**.

In the secondary inner chamber **516**, a printed circuit board **518** is housed.

Advantageously, the appendage of the container **500**, formed by the appendages **510**, **512** of the container portions **502**, **504**, extends obliquely from the main region of the container **500** formed by the main regions **506**, **508** of the container portions **502**, **504**, so as to extend along the inner plate **26** of the chain guide **14**, with the advantages outlined above.

The board **518** carries the management circuit of the battery power supply unit **24**, which similarly to the first embodiment is connected through cables **520** to the terminals of the battery power supply unit **24**, to form a so-called smart battery.

The inner chambers **514**, **516** communicate with each other, so as to allow the passage of the cables **520**.

In this case, the board **518** also carries the recharging circuit of the battery power supply unit **24**, as well as the recharging port **72**, which in this case will be absent from the board **176** housed in the support body **12**—the changes to the electrical connections being manifest to those skilled in the art in the light of the present description.

The management circuit made on the board **518** is connected to a three-conductor cable **522** that extends from the board **518** and comes out from the container **500** in a manner totally analogous to the first embodiment.

The three-conductor cable **522** is also preferably provided with a connector **524**, corresponding to the connector **202** of the first embodiment.

The management circuit made on the board **518** is also suitably connected to the recharging circuit made on the same board **518**.

During use of the electronic gearshift, the three-conductor cable **522** also in this case carries the power supply from the battery power supply unit **24** to the users, and in particular to the motor gear **22**, housed in the support body **12**, as well as data signals that are exchanged between the smart battery and the remaining electrical/electronic components housed in the support body **12**, for example information on the detected temperature or on the residual charge.

The three-conductor cable **522** does not, on the other hand, carry the power supply for recharging the battery power supply unit **24**.

In greater detail, the recharging port **72** is fixed to the appendage **510** of the first container portion **502**, and the appendage **512** of the second container portion **504** has an opening **526** for accessing the recharging port **72**.

Advantageously, also in this case a removable cover **74** of the recharging port **72** is provided, totally analogous to that of the first embodiment. The small nail **80** of the cover **74** is fixed in a hole **528** formed for example in a flange **530** of the appendage **512** of the second container portion **504**.

Preferably, the appendage **510** of the first container portion **502** carries a support element **532** for the recharging port **72**, upright in the secondary inner chamber **516**.

The support element **532** has a seat **534** recessed within a side wall thereof, having a shape compatible with that of the recharging port **72**. The recharging port **72**, positioned in the seat **534**, is fixed to the support element **532**, for example screwed by means of screws **536** inserted in unthreaded holes **538**, formed on flanges **540** of the recharging port **72**, and screwed into threaded holes **542** formed on the support element **532**.

It is also possible to avoid the support element **532** and fix the recharging port **72** directly on the board **518**, by providing the opening **526** for accessing the recharging port **72** on a side face of the appendage **512** of the second container portion **504**.

It should be understood that the configuration of the container **500**, with the appendage defining the secondary inner chamber **516** and housing the recharging port **72**, of the fourth embodiment can also be used in the case of a container supported by one or more holding devices **302** as described above with reference to the chain guide **300** of the second embodiment, the changes to be made to the container **500** being manifest to those skilled in the art in the light of the present description.

It is also manifest that the recharging port could also be provided in the case of a container without appendages, like for example the container **32**, **304** of the first or of the second embodiment, provided that the respective inner chamber **54** is sufficiently large.

FIGS. **13-15** illustrate the chain guide **600** of an electric front derailleur according to a fifth embodiment of the invention, which supports the battery power supply unit **24**. Components that are the same or similar to those of the first or third embodiment are not described in detail.

Also in this case, the battery power supply unit **24** is supported, through a container **602**, in particular by the inner plate **604** of the chain guide **600**.

In this embodiment, the change concerns both the chain guide **600** and the container **602** housing, among other things, the battery power supply unit **24**.

In this case, the container **602** is substantially irremovably supported by the chain guide **600**.

In particular, in the embodiment shown, the container **602** comprises a portion **606** for housing the battery power supply unit **24** that is made in a single piece with the chain guide **600**.

Even more specifically, making the housing portion **606** of the container **602** and the chain guide **600** in a single piece takes place through co-molding.

For this purpose, the inner plate **604** of the chain guide **600** comprises holes **608** that make an undercut with respect to the inner face of the inner plate **604** itself, as can be seen in the cross-section view of FIG. **14**. The material of the container **602**, during molding, fills such holes **608** and, thanks to the undercut, forms an enlarged head **610** that holds the container **602** on the chain guide **600**.

The housing portion **606** has an opening **612**, through which it is possible to insert and remove the battery power supply unit **24**.

In the embodiment shown, the opening **612** is made on the inner face of the housing portion **606** of the container **602**.

In the case shown, a door **614** is provided for closing the opening **612**.

The door **614** is co-molded with the housing portion **606** of the container **602**, and thus is co-molded with the chain guide **600**.

In particular, in the embodiment shown, the door **614** is hinged to the housing portion **606** through a thin, and therefore flexible, strip of material **616**.

The door **614** and the housing portion **606** are respectively provided with a hook **6318** and with a lug **620** for hooking the hook **618** to keep the door **614** in closed condition.

The door **614** preferably comprises a collar **622** that seats into a groove **624** of the housing portion **606** of the container **602**.

A gasket could be housed in the groove **624** to improve the tightness of the container **602**.

In addition to the battery power supply unit **24**, a printed circuit board **626** is housed in the housing portion **606**.

The board **626** carries the management circuit of the battery power supply unit **24**, which similarly to the first

embodiment is connected to the terminals of the battery power supply unit **24** to form a smart battery.

The management circuit carried by the board **626** is suitably connected to a three-conductor cable **628** that extends from the board **626**.

The three-conductor cable **628** comes out from the container **602** through an opening **630**.

The opening **630** is preferably sized for the passage of a removable connector **632**, analogous to the removable connector **202** of the first embodiment.

The opening **630** is preferably recessed within a seat **634**, which houses an annular cover **636**, the inner hole **638** of which is sized in accordance with the three-conductor cable **628**.

The board **626** can furthermore carry the recharging circuit of the battery power supply unit **24**, as discussed with reference to the previous embodiments.

The door **614** could, as an alternative to making it through co-molding and to its hooked closure, be differently fixed to the housing portion **606**, for example welded or glued, or it could be removably constrained to the housing portion **606**, for example through screwing.

Alternatively or in addition, the opening **612** and the related door **614** could be made on another face of the container **602**, for example on the bottom face of the housing portion **606** of the container **602**, which is opposite the (upper) face of the container **602** that faces towards the support body **12**.

It should also be understood that the container **602** could be configured with an appendage defining a secondary inner chamber in an analogous manner to the third or fourth embodiment, with all of the variants and generalizations indicated for such embodiments.

The above is a description of various embodiments of inventive aspects, and further changes can be made without departing from the scope of the present invention. The shape and/or size and/or location and/or orientation of the various components can be changed. The functions of a component can be carried out by two or more components and vice-versa. Components shown directly connected to or contacting each other can have intermediate structures arranged between them. The details shown in a figure and/or described with reference to a figure or to an embodiment can apply in other figures or embodiments. Not all of the details shown in a figure or described in a same context have to necessarily be present in a same embodiment. Features or aspects that turn out to be innovative with respect to the prior art, alone or in combination with other features, should be deemed to be described per se, irrespective of what is explicitly described as innovative.

It should be understood that, in all of the embodiments of the electric front derailleur according to the invention, the configuration of the support body **12**, of the linkage **16** and of the motor gear **22** can be substantially different from what has been described above merely as a non-limiting example.

For example, it should be expressly mentioned that, as an alternative to the articulated parallelogram, the linkage **16** can for example comprise a rack system or a worm screw system.

In all of the embodiments of the electric front derailleur, the motor gear **22** can be replaced by the electric motor **218** only.

It is not necessary for the motor gear **22** to be coupled with and to directly drive the outer connecting rod **20** of the articulated parallelogram linkage **16**. It could be coupled with the inner connecting rod **18**. Alternatively, the motor gear **22** could be arranged along the diagonal of the articulated parallelogram. Still as an alternative, a different linkage could be used, coupled in a suitable manner with the motor gear **22**, or furthermore a different electromechanical actuator could be used, for example comprising one or more linear motors directly coupled with the chain guide without any interposed linkage.

The shape of the support body **12** and the connection means **13** to the frame of the bicycle **1100** can be substantially different from what is illustrated and described.

The shape of the inner and outer plates of the chain guide, in particular in terms of their interaction with the chain **1101** and with the linkage **16**, can also be remarkably different from what is illustrated and described.

Furthermore, although in the various embodiments shown and described, the battery power supply unit **24** is always supported by the inner plate of the chain guide, it could be supported by the outer plate of the chain guide.

As an alternative to the removable connectors, between the battery power supply unit and the motor gear and/or the electronics powered thereby, a fixed electrical connection can be provided, or a sliding contact can be provided.

It is also worthwhile emphasizing that the battery power supply unit **24** could be provided only for supplying power to the electronics, the electric motor **218** of the motor gear **22**, on the other hand, being powered by another battery power supply unit, for example shared with the rear derailleur.

What is claimed is:

1. An electric front derailleur of a bicycle, comprising a support body that is configured to be attached to a frame of the bicycle, a chain guide connected to the support body through a linkage, an electric motor that drives the linkage to displace the chain guide among toothed wheels of a motion transmission system, and a battery power supply unit, wherein the battery power supply unit is supported by the chain guide.

2. The derailleur according to claim **1**, wherein the battery power supply unit is provided for supplying power to the electric motor and/or to at least one electrical/electronic component of the derailleur.

3. The derailleur according to claim **1**, wherein the battery power supply unit is housed within a container.

4. The derailleur according to claim **3**, wherein the container housing the battery power supply unit is removably supported by the chain guide.

5. The derailleur according to claim **3**, wherein the container comprises a portion for housing the battery power supply unit that is fixedly supported by the chain guide.

6. The derailleur according to claim **5**, wherein the housing portion of the container is made in one piece with the chain guide.

7. The derailleur according to claim **5**, wherein an opening of the housing portion of the container is made on an inner face of the housing portion of the container.

8. The derailleur according to claim **1**, wherein the chain guide comprises an inner plate and an outer plate, and the battery power supply unit is supported by the inner plate.

9. The derailleur according to claim **1**, further comprising a management circuit of the battery power supply unit.

10. The derailleur according to claim **1**, further comprising a recharging circuit for providing a recharge voltage and/or current of an intensity controlled over time to the battery power supply unit.

11. The derailleur according to claim **2**, wherein the motor and/or at least part of electrical/electronic components powered by the battery power supply unit are fixedly supported on the support body.

12. The derailleur according to claim **11**, wherein a flexible cable connects a container housing the battery power supply unit and the support body.

13. The derailleur according to claim **1**, wherein a recharging port is provided for removable connection of the battery power supply unit to electrical mains through a cable or a recharging device provided with a matching connector.

14. The derailleur according to claim **13**, wherein the recharging port is fixedly supported on the support body, or is supported by the chain guide.

15. The derailleur according to claim **13**, further comprising a cover for protecting the recharging port when the cable or recharging device is not present.

16. The derailleur according to claim **6**, wherein the housing portion of the container is co-molded with the chain guide.

17. The derailleur according to claim **9**, wherein the management circuit is housed within the same container as the battery power supply unit.

18. The derailleur according to claim **10**, wherein the recharging circuit is supported by the support body.

19. The derailleur according to claim **10**, wherein the recharging circuit is supported by the chain guide.

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